WRD Resource Room OLYM

Value Planning

Final Report

Elwha River Water Quality Mitigation Project
50-Percent Concept Development

A1R-1751-3408-NPS-11-0-5 (1); ELWH3

November 14, 2000

Conducted in Cooperation with the
National Park Service, the City of Port Angeles, and
the Bureau of Reclamation, Pacific Northwest Region

Bureau of Reclamation, Technical Service Center, Denver, Colorado

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Executive Summary

The Value Study Team (Team) met on November 6, 2000, for a 3-day study of four water quality mitigation concept alternatives developed for the Elwha River Water Quality Mitigation Project by URS, a consultant for USBR. A Value Planning Study of the 10-percent concept of this project was finalized October 10, 2000. The estimated total cost of the four alternatives ranges from $52,811,000 to $88,350,000. The Team developed eight proposals which are summarized below. If all the avoidance proposals are accepted, their maximum avoidance potential is $21,000,000. In calculating the maximum potential avoidance, the study cost of ($20,000) was deducted only once.

Due to the size and scope of the project and the limited time available for the study, the team was only able to "scratch the surface" in terms of analyzing functions, generating ideas and developing proposals. Future studies should each be at least a five-day effort, for a project of this size.

Independent Proposals: The following proposals are generally independent of all other proposals and could be accepted or rejected individually without affecting other proposals. Only Proposal Nos. 1 and 2; and Proposal Nos. 1 and 5 or 6 could not be fully combined.

<u>Proposal No. 1</u>. System Operation Overview and Analysis. The estimated avoidances of this proposal are $ 9,286,000 for scenarios 1 and 2, and $5,194,000 for scenario 3, before deducting any study costs and before adding implementation avoidances.

<u>Proposal No. 2</u>. Reuse Water from the State Hatchery to Supply the Daishowa Mill. The estimated avoidances of this proposal are $9,988,000 before deducting any study or implementation costs.

<u>Proposal No. 3</u>. Cased Wells to Replace One Ranney Collector Well. The estimated avoidances of this proposal are $ 1,367,000 before deducting any study or implementation costs.

<u>Proposal No. 4</u>. Replace Conventional Treatment with Membrane Filtration. The estimated avoidances of this proposal are $ 3,156,000 before deducting any study or implementation costs.

<u>Proposal No. 5</u>. Ranney Well Capacity. The estimated avoidances of this proposal are $10,108,000 before deducting any study and/or implementation costs.

<u>Proposal No. 6</u>. Location of First New Ranney Well to be Installed. There are no avoidances associated with this proposal. Installing the first new well permits the determination of whether operation of one well affects the capacity a neighboring well.

<u>Proposal No. 7</u>. Sequential Installation of Ranney Wells. There are no avoidances associated with this proposal. Specifying the sequence of well construction increases the probability that the wells will have the required capacity.

<u>Proposal No. 8</u>. Salvage and Reuse the Rayonier Water Supply Pipeline. The estimated additional costs of this proposal are $572,000 before adding study and/or implementation costs.

Other Ideas: The Team identified 25 additional ideas for further consideration and development that are listed in the "Disposition of Ideas" table near the end of this report.

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Acknowledgment of Design Team and Consultant Assistance

The Value Study Team wishes to express their thanks and appreciation to the Design Team Leader, Ms. Ellen Abart, and the members of the design team, who cordially provided all requested information and consultation on the conceptual design. The team would not have been as successful without the design team's cooperation and assistance.

The Value Study Team wishes also to express thanks and appreciation to those listed on the Consultation Record of this report. Their cooperation and help contributed significantly to the technical foundation and scope of the team's investigation and final proposals.

The goal of the value method is to achieve the most appropriate and highest value solution for the project. It is only through the effort of a diverse, high performing team, including all those involved, that this goal can be achieved.

Value Method Process

The study process follows a Job Plan that provides a reliable, structured approach to the conclusion. Initially, the team examined the component features of the program, project or activity to define the critical functions (performed or desired), governing criteria, and associated costs. Using creativity (brainstorming) techniques, the team suggested alternative ideas and solutions to perform those functions, consistent with the identified criteria, at a lower cost or with an increase in long term value. The ideas were evaluated, analyzed and prioritized, and the best ideas were developed to a level suitable for comparison, decision making and adoption.

This report is the result of a "formal" Value Study, by a team comprised of people with the diversity, expertise, and independence needed to creatively attack the issues. Ideally, the team members have not been notably involved in the issues prior to the study. The team applied the Value Method to the issues and supporting information, and took a "fresh look" at the problems to create alternatives that fulfill the client's needs at the greatest value.

Due to the size and scope of the project and the limited time available for the study, the team was only able to "scratch the surface" in terms of analyzing functions, generating ideas and developing proposals. At least one more concept stage/level value study is being planned. That study should be at least a five-day effort to allow the study team more time for the job plan activities. Design stage value studies should also allow at least five-days per study, for this size project.

Current Description

The Elwha Act, PL 102-495, calls for full restoration of the ecosystem and habitat for anadromous species in the Elwha River watershed, including deconstruction of the Elwha and Glines Canyon Dams. As the dams are removed (short-term), the entrapped sediments will be released in high concentration periods, approximately every two weeks as notches are cut lower and lower in the dams. During these high concentration periods the sediments will "pulse" through the lower reaches of the Elwha River. After dam removal, the sediment load (long-term) in the river is expected to return to natural pre-dam levels. Both short-term and long-term sediment loads will reach the intakes for the City of Port Angeles municipal and industrial supplies and fisheries (hatcheries) for both Washington State and the Lower Elwha Klallam Indian Tribe, among other water users. See Figure 1.

The Elwha River Water Quality Mitigation Project is intended to reduce or eliminate the adverse impacts of short-term and long-term sediment loads, as well as other water quality impacts, to the downstream water users. The October 10, 2000, value planning report for the 10-percent concept development provides additional project background.

The design flows assumed by the 50-percent concept development in million gallons per day (mgd) and cubic feet per second (cfs) are:

Port Angeles Municipal,	10.6 mgd	(16.4 cfs);
Daishowa (industrial),	20.0 mgd	(31.0 cfs);
WDFD Fish Rearing Channel,	21.3 mgd	(33.0 cfs);
Lower Elwha Klallum Tribe Fish Hatchery	17.4 mgd	(27.0 cfs);
Port Angeles reserve industrial rights	44.5 mgd	(69.0 cfs);
TOTAL	113.8 mgd	(176.4 cfs)

The 50-percent concept development is considering four alternatives. All four alternatives assume addition of a treatment plant downstream of the existing Ranney Well to provide municipal water supply. The estimated cost of this common part of the alternatives is $17,212,998 construction cost (or $20,655,598, including a 20-percent factor for engineering, survey and construction management). The alternatives differ principally in how they provide industrial and fisheries water supplies. None of the alternatives provides for treatment for the reserve industrial rights.

Alternative 1 provides both industrial and fisheries water by construction of an infiltration gallery sized for 103.2 mgd and a pre-treatment facility sized for 58.7 mgd (no treatment for the reserve industrial rights). See Figure 2.

Alternative 2 provides both industrial and fisheries water by construction of 6 new Ranney wells sized for a total of 58 mgd. See Figure 3.

Current Description

Alternative 3 provides both industrial and fisheries water by construction of an infiltration gallery and a storage reservoir sized to handle a 5-day detention time for 58 mgd (about 45 acres, 20 feet deep). See Figure 4.

Alternative 4 provides both industrial and fisheries water by construction of an infiltration gallery. During periods of high turbidity and insufficient suspended solids removal by the gallery, an Elwha River source upstream of Lake Mills would be used to supply water for industries and fisheries. See Figure 5.

The study team questioned Tim Randle of the United States Bureau of Reclamation, D-8540 about the duration and sediment loads during and after dam removal. He confirmed that the durations of high sediment loads are expected to be only one to two days, with one important exception. When the lowest 30 or so feet of Glines Canyon Dam is removed, the duration of high sediment loads (> 10,000 milligrams per liter (mg/L) may last about 39 days.

Figure 1. Location Map

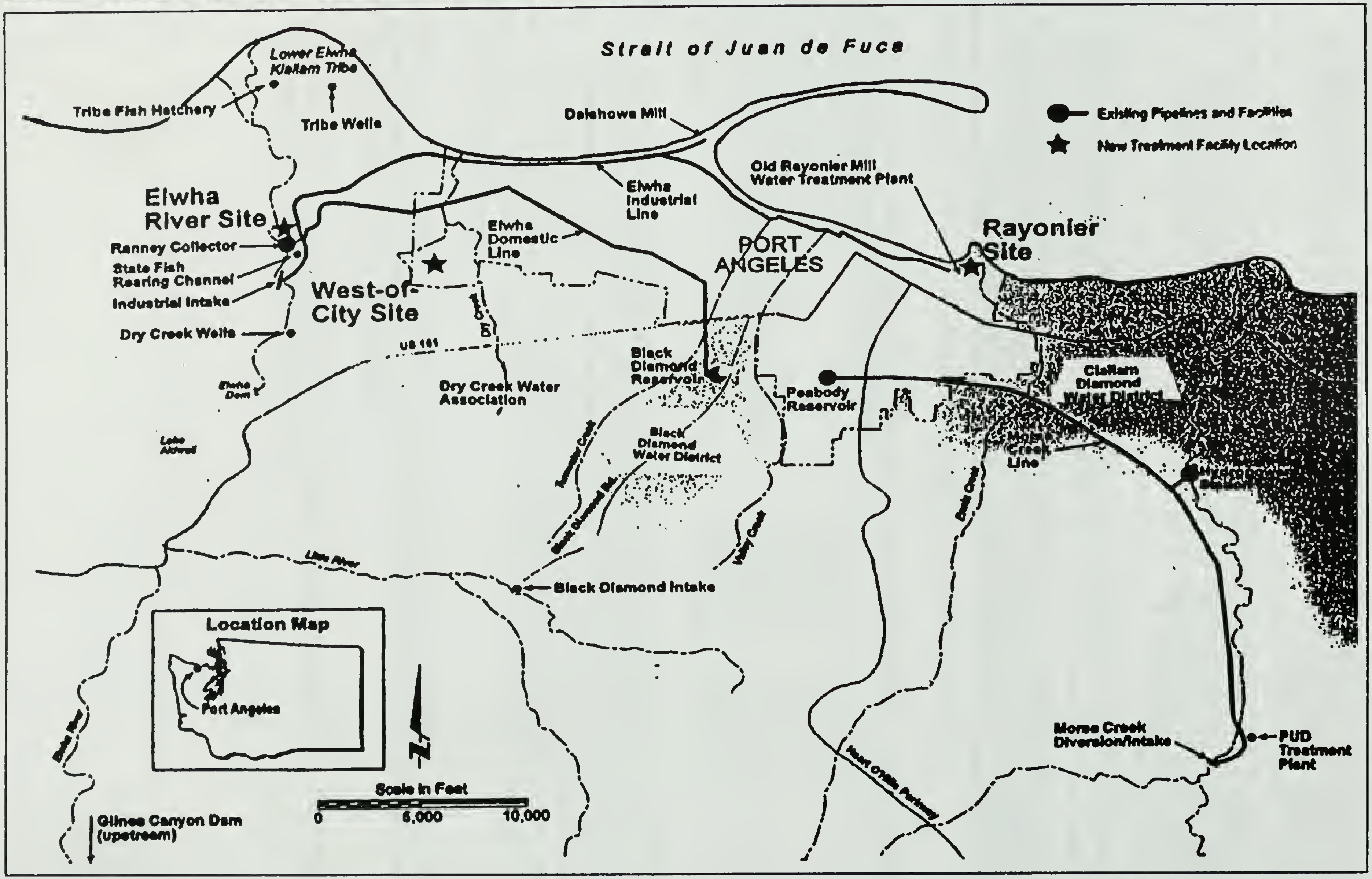


Figure 2. Concept Alternative 1

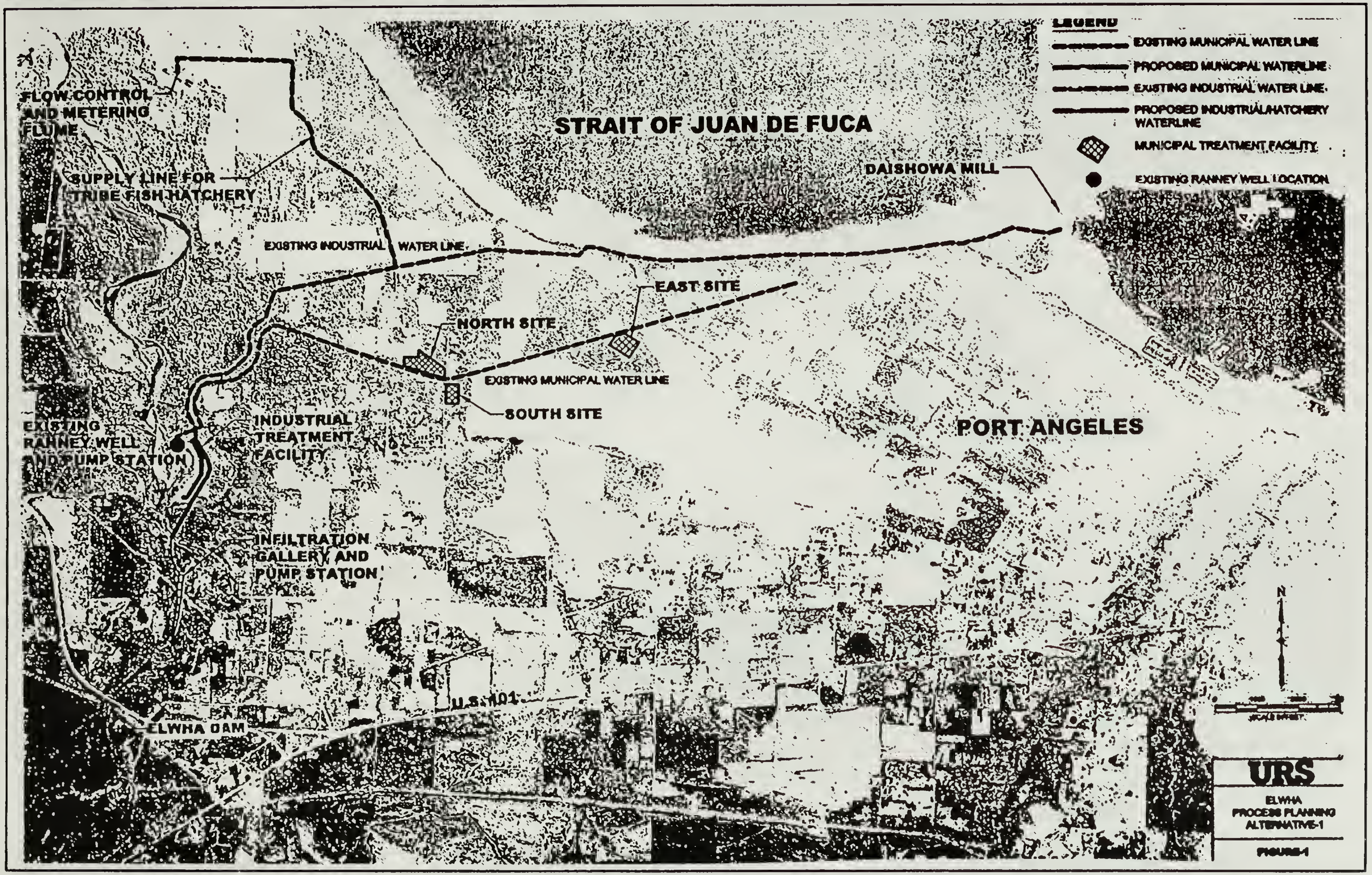


Figure 3. Concept Alternative 2

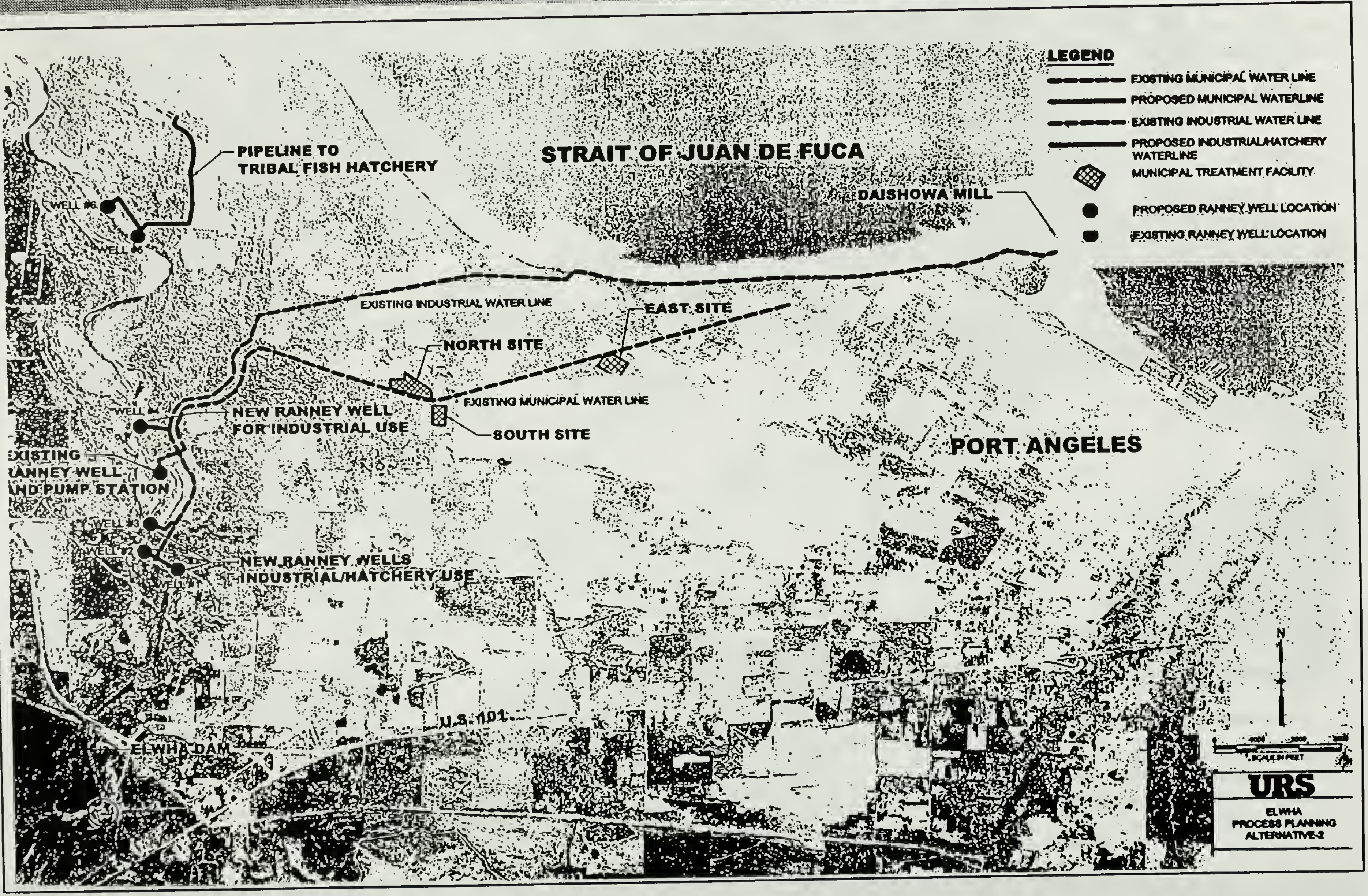


Figure 4. Concept Alternative 3

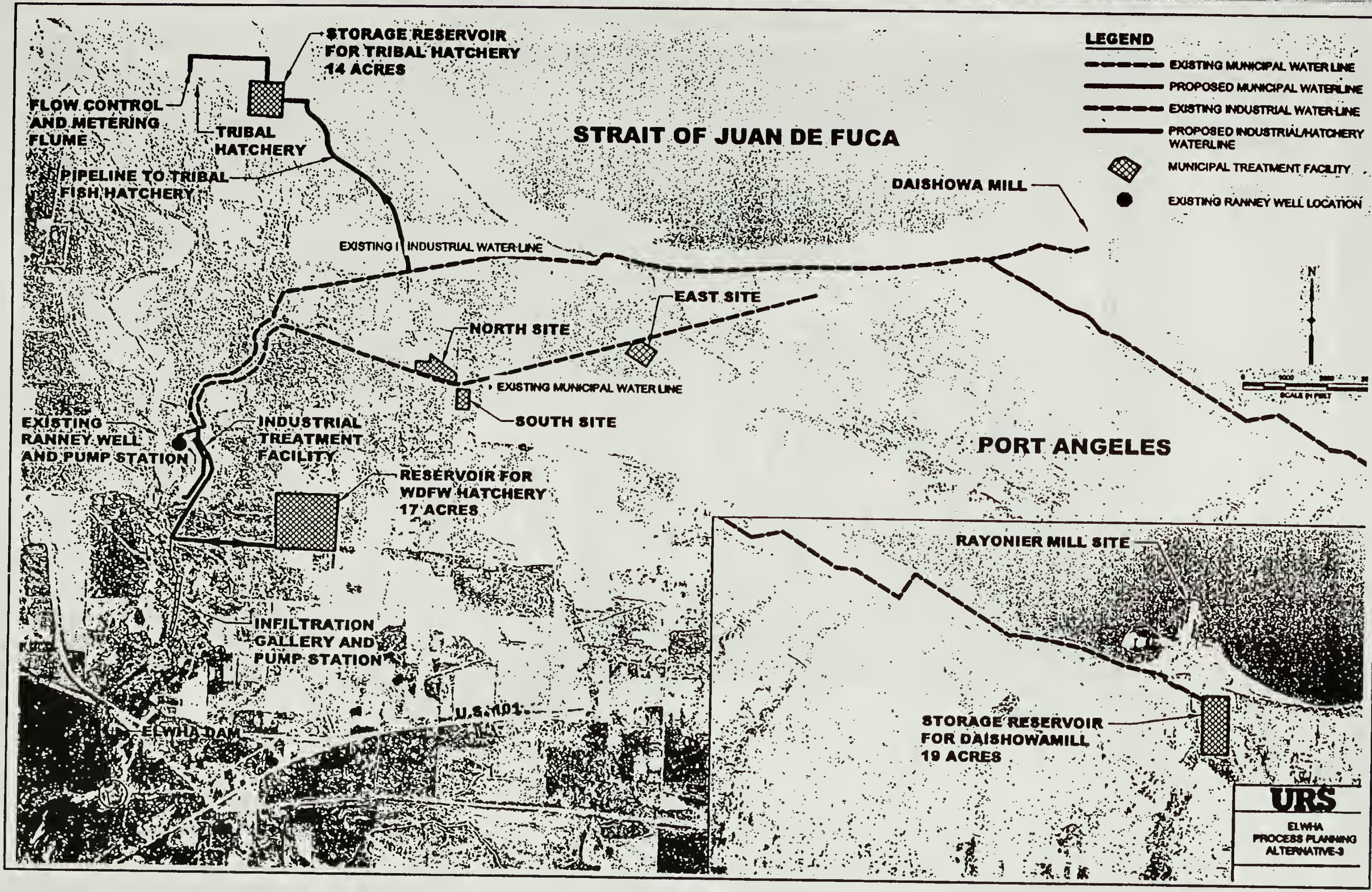
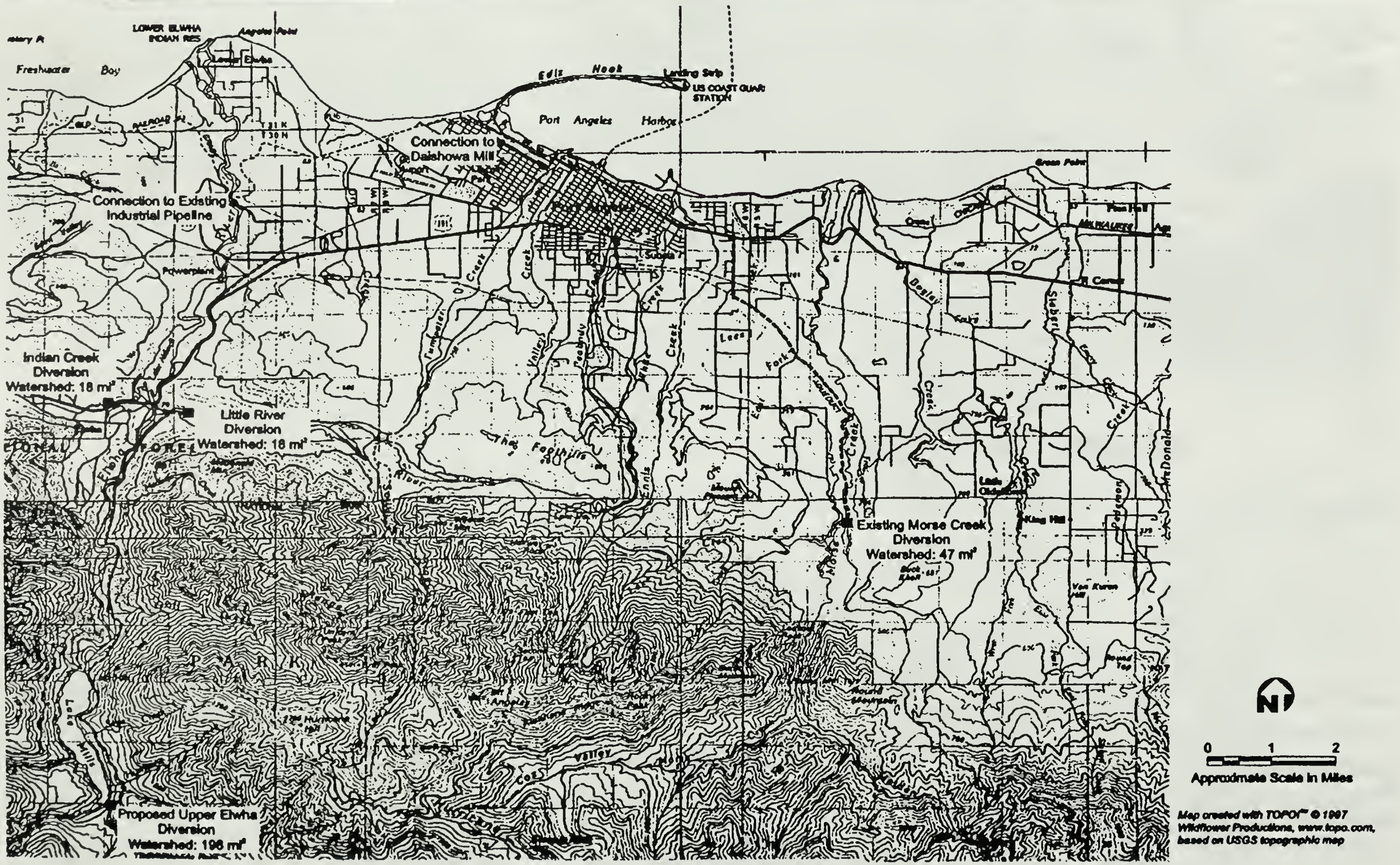


Figure 5. Concept Alternative 4



ALTERNATIVE TEMPORARY WATER SOURCES

Owner, Users, and Stakeholders List

Identification and Issues Determination

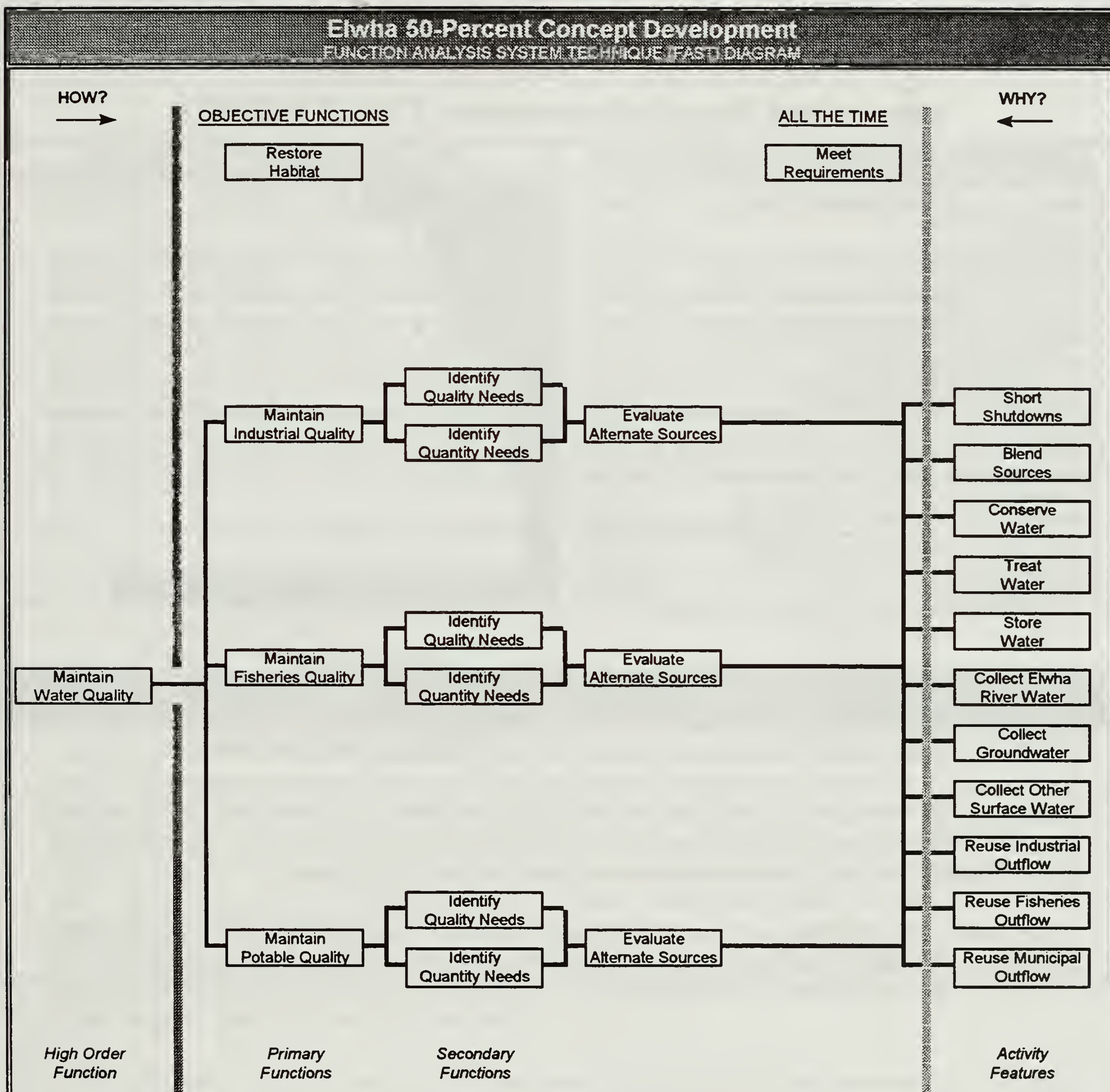
Owner (Identification of the owner or owners)	Owner Issues (Identification of issues important to every owner)	Desire/ Criteria
National Park Service	Anadromous Habitat Restoration Elwha Act Compliance	C C
User (Identification of the user or users)	**User Issues** (Identification of issues important to every user)	**Desire/ Criteria**
City of Port Angeles	Maintenance of water quality and supply Operations and Maintenance Effort/Cost GWI compliance (groundwater under influence of surface water)	C C,D C
Daishowa Mill	Industrial water quality and supply Operations and Maintenance Effort/Cost	C C, D
Lower Elwha Klallam Tribe	Fishery water quality and supply Anadromous Species Habitat	C C
Washington State Department of Fish and Wildlife	Fishery water quality and supply Anadromous Species Habitat	C C
Dry Creek Water Association, Elwha Place Water Association	Water quality and supply	C
Stakeholder (Identify of the stakeholder or stakeholders)	**Stakeholder Issues** (Identification of issues important to every stakeholder)	**Desire/ Criteria**
Washington State Department of Health	Meet Drinking Water Regulations Approval of Project Plan	C C
Washington State Department of Ecology	Regulation, Water Rights	C
National Marine Fisheries Service	Anadromous Species Habitat	C, D
U.S. Fish and Wildlife Service	Anadromous Species Habitat	C, D
Elwha Morse Management Group	Restoration	C, D
Clallum County	Permitting	C
Public	Water Quality and Supply Anadromous Species Habitat Local Economy	D D D

Function Analysis

Component	Active Verb	Measurable Noun
Elwha Act	Restore	Habitat
Project	Mitigate	Sediment Effects
Intake Structure	Supply	Water
	Exclude	Coarse Sediments
Ranney Well	Supply	Water
	Exclude	Coarse Sediments
Channel/pipeline/tunnel	Transport	Water
Treatment Facility	Clean	Water
Reservoir	Store	Water
Conservation	Reduce	Use/Demand
Recycling	Reuse	Water
Blending	Control	Quality
	Stretch	Supply
Sediment Model	Establish	Criteria
Design Criteria	Direct	Design Effort

Function Analysis System Technique (FAST)

The Value Study Team used the function-analysis process to generate a Function Analysis System Technique (FAST) diagram, designed to describe the present solution from a functional point of view. The FAST diagram helped the Team identify those design features that support critical functions and those that satisfy noncritical objectives. The FAST diagram also helped the Team focus on potential value mismatches, and generate a common understanding of how project objectives are met by the present solution.



Activity-Oriented FAST Diagram

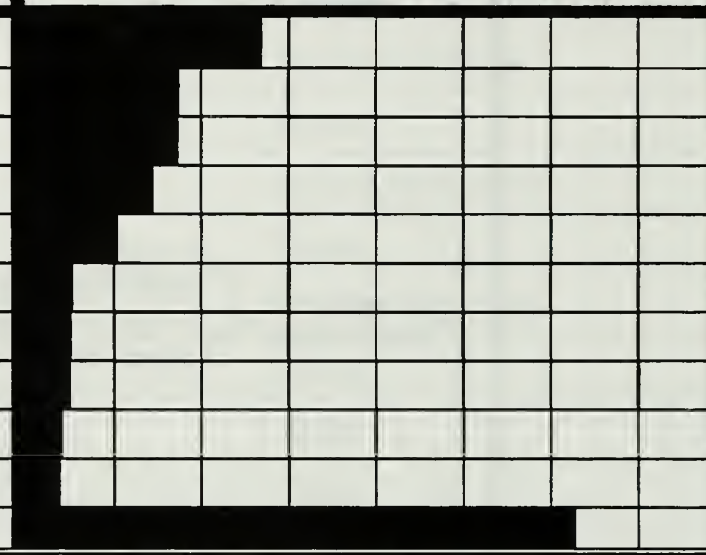
Elwha River Water Quality Mitigation

50-Percent Concept Development Value Study

Municipal Supply/Treatment COST MODEL

COMPONENT/PERCENT PROJECT COST	
Electrical/Instrumentation/Controls	(15.5%)
Mob/Demob	(10.1%)
Plate Settlers	(10.1%)
Concrete in Flocculation/Sediment	(8.4%)
Concrete in Clear well	(6.1%)
Concrete in Filter Complex	(3.1%)
HVAC	(3.0%)
Excavation for Flocculat/Sediment	(3.0%)
Backfill in Flocculation/Sediment	(2.4%)
Equipment in Filter Underdrain	(2.3%)
All Other Items	(36.0%)

PROJECT COST PROPORTION



Cost Model and Estimate Information

The Value Study Team cost model is based on the conceptual design estimates provided by the design team for the preferred project design. The cost model was developed by the Value Study Team and was used to focus on features with the greatest potential for savings and to highlight areas of value mismatch. Unit prices were reviewed by the Cost Estimator and Value Study Team members, to ensure reliability and applicability.

Cost avoidances/savings and the original design concept estimates are of the same general level of development, although these costs may vary as final designs are pursued.

Proposal No. 1

Description

Proposal No. 1. System Operation Overview and Analysis.

- Proposal Description: The four concept alternatives are designed to meet ultimate municipal, industrial, and hatchery use (see table below) under short-term severe river water environmental (stress) conditions. Specifically, each of the four alternatives has been sized and preliminary design based on the 97-percent interval (high total suspended solids, TSS, loading) for water quality and for the projected water demand. The Elwha River intake facilities initial design has been established for a raw water quality in the river of 10,000 mg/L of TSS. Table 1, from the DRAFT study report by URS, shows ultimate demand and proposes to use separate water intake for each facility from the Elwha River for each separate demand.

TABLE 1 - CURRENT/PROPOSED DESIGN

Port Angeles Municipal	10.6 mgd
Daishowa Paper Mill	20.0 mgd
State Fish Rearing Channel	21.3 mgd
Lower Elwha Klallum Tribe Hatchery	17.4 mgd
Port Angeles Reserve Industrial Rights	44.5 mgd
Total Water Supply Demand	113.8 mgd

- Each water intake is sized to meet each combination of entities' individual water demand, and the potential for water reuse has not been fully explored. Discharge from the State Fish Hatchery could be used during high river TSS loading to supply water to the Paper Mill. Also high TSS and low TSS river water could be blended, high quality water from storage (e.g., reservoirs) could be reclaimed, municipal water supply could be supplemented with alternative raw water sources to maintain water quantity and quality for specific uses. Educational and public information program(s) promoting water conservation during short stress periods could also be implemented.

- Periods of peak sediment loads in the River were discussed with the personnel performing the study by the Bureau of Reclamation. Spikes of high sediment concentrations (around 10,000 mg/L or higher) have very short duration with one exception (discussed below). Time of concentration for the watershed is measured in hours and spikes of high solids concentrations in the River are expected to pass within a 24-hour period. The one exception to this scenario is the removal of the last 30 feet of Glines Canyon Dam. During the removal of this last segment, the sediment model predicts that there will be a period of 12-days of high solids concentration followed by a period of eight days with concentrations in the 5,000 mg/L range again followed by another period of high solids concentration that would last for 19 days.

The River would then, within a day, return to TSS concentrations (less than 200 mg/L) that would be acceptable to reopen the existing surface water intake for industrial and fisheries use.

Proposal No. 1

Short term industrial/fisheries water needs, without reclamation or recycling, are shown for each of the water users under two different operating scenarios in Table 2. During the summer months, adult fish populations are present in the hatcheries; and therefore, higher water demands to support the fishery is shown in the "typical" column. Also, water demand by the city is expected to be higher during the summer months. If the final segment of the Glines Canyon Dam is removed in the late fall or early winter when fish eggs are hatching or young fry are present, the demand for water at the two hatcheries would be significantly reduced, with values as shown in the minimum column of Table 2.

TABLE 2 - SHORT-TERM NEEDS

Entity	Typical (summer)	Minimum (winter)
Port Angeles Municipal	6.0 mgd	3.4 mgd
Daishowa Paper Mill	10.0 mgd	10.0 mgd
State Fish Rearing Channel	21.3 mgd*	1.0 mgd
Lower Elwha Klallum Tribe Hatchery	7.4 mgd*	1.0 mgd
Port Angeles Reserve Industrial Rights	0.0 mgd	0.0 mgd
Total Water Supply Demand	44.7 mgd	15.4 mgd

*These values represent the high water demand period of the summer months from the hatcheries. These demands could be significantly lower (e.g., 1 mgd) during November, December, and January months.

With a total water demand between 15 mgd to 45 mgd , the study team reviewed possible system operating options that could minimize the number or size of facilities to be constructed to address the short term, high TSS loading in the Elwha River. These operating options are listed below, in no particular order, since use of any option will depend on specific water demands. The options are as follows:

1. Blend high TSS Elwha River water with higher quality Ranney well water.
2. Reclaim state fish hatchery effluent to augment supply to Daishowa Mill/Tribe fishery.
3. Develop new Ranney well(s) or supplement with groundwater wells.
4. Augmentation of water supply system from new water reservoir.

- In all the above options, the study team believes that the need for the Elwha River infiltration gallery in all of the proposed water mitigation alternatives is not warranted.

- Due to time constraints, only Alternative 2 has been evaluated, because of its initial favorability of the four alternatives. Under the "typical" water demand operating scenario, this scenario appears to be likely to occur, with the final step of the Glines Canyon Dam being removed during the summer months and just prior to the Chinook run on the Elwha River. The water system as shown in Figure 6 would consist of the existing Port Angeles Ranney well, construction of the two new Ranney wells (identified as wells No. 2 and No. 3 in Alternative 2). Alternative 2 would be reconfigured to provide water reuse in order to maintain higher water quality during severe TSS Elwha River concentrations. Based on the above operating scenario, Table 3 is a compilation of water sources.

Proposal No. 1

Table 3
Water Sources with Quantities

Existing Ranney Well	10.6 mgd
New Ranney Wells Nos. 2 and 3	21.4 mgd
Total Water Supplied [with River intake closed]*	31.4 mgd

[Under this operating scenario the River intake would be closed when TSS exceeds 200 mg/L.; and no existing well supplies are used]

The three scenarios described below are part of a spectrum of operating scenarios that should be considered. They are only examples, and the flow quantities used require verification.

Scenario 1 - Typical Demand Water use under this operating strategy would be as follows (and as shown in Figure 6):

1. The City would use 6.0 mgd of the existing Ranney well production with the remainder or 4.6 mgd added to the industrial supply
2. The two new Ranney wells would produce 21.3 mgd which would be used by the State hatchery. The State Hatchery would send 12.8 mgd of effluent to the industrial supply and the remaining 8.5 mgd discharged would be sent to the River.
3. The hatchery effluent would be diluted with 4.6 mgd excess from the existing Ranney well. This total (12.8 + 4.6 mgd) amounts to 17.4 mgd to be split with 7.4 mgd to the Tribal hatchery and 10 mgd sent to the Daishowa Paper Mill.

Scenario 2 - Minimum Demand

- Similar to Scenario 1, this option uses the same number and types of sources, but the dam is removed in the winter, when the hatchery demands are low. The industrial demand would be less based on the timing for removal of the last 30 feet of the Glines Canyon Dam. The capital cost anticipated for this scenario would be approximately the same as operating Scenario 1. Should this removal occur after the salmon migration season, water demand by the two hatcheries would drop to approximately 1 mgd each. Figure 7 indicates the water balance under operating Scenario 2 (minimum demand conditions) and would be operated as follows:

1. The new Ranney wells would supply 3.8 mgd total, with 1.0 mgd sent to the State hatchery.
2. The excess production from the City of Port Angeles Ranney well or 7.2 mgd would be sent to the industrial demand, along with all the production from the new Ranney wells would also be sent for the remaining industrial demand. Flow from the new Ranney wells would include 2.8 mgd that is unused, and the 1 mgd effluent from the State hatchery.
3. The 11.0 mgd remaining industrial demand would consist of 10 mgd to Daishowa and 1.0 mgd to the Tribal hatchery.

Scenario 3 - No Reclamation

Similar to Scenario 1, this option uses one additional new Ranney well. The industrial demand would be based on the timing for removal of the last 30 feet of the Glines Canyon Dam.

Proposal No. 1

The capital cost anticipated for this scenario would be somewhat greater than for operating Scenario 1. Figure 8 indicates the water balance under this operating Scenario 3 (typical demand conditions) and would be operated as follows:

1. The new Ranney wells would supply 34.1 mgd total, with 21.3 mgd sent to the State hatchery, and 12.8 mgd sent to the additional industrial demand.
2. The excess production from the City of Port Angeles Ranney well or 4.6 mgd would be used to augment the industrial demand.
3. The 17.4 mgd remaining industrial demand would consist of 10 mgd to Daishowa and 7.4 mgd to the Tribal hatchery.

- <u>Critical Items to Consider</u>:
  Requires River monitoring and communication between system operation and dam removal operations.
  Requires communication between water users and system operation during onset of stress periods.
  Requires proper system reconfiguration during onset of stress periods.
  Promotes development of a water conservation program and public education for water users.
  Requires reconsideration of dam removal program to coincide with low water demands.

- <u>Ways to Implement</u>:
  Develop operational strategies that include complete consideration of all anticipated River conditions and water demands. These will include consensus of all water users involved for all anticipated operating conditions.
  Use control signals from watershed monitoring system to initiate system operating reconfiguration (e.g., shut raw water intake valve, etc.)

- <u>Changes from the Baseline Concept</u>:
  No infiltration galleries require construction.
  No chemical treatment required, thus eliminating the need for pretreatment.
  Produces a more acceptable water quality for use by the hatcheries.
  Capital facilities are established for the minimum acceptable operation during stress periods.
  Will require development of watershed monitoring program to assist in the identification of River stress periods.

Advantages	Disadvantages
• Maximizes water supply during stress period. • Provides blending opportunities.	• Increases operation complexity. • Promotes all parties to practice water conservation during stress period.

Proposal No. 1

• Lower capital costs and anticipated operating costs. • Minimizes disruption to River bed. • Maximizes current facilities. • No land acquisition except Scenario 3. • Maintain current surface water intake. • Meets intent of Environmental Impact Statement (EIS). • Provides cooler water to the hatcheries.	• Increased River monitoring. • Possible operational constraints due to blending and reuse needs.

Potential Risks

1. Duration of River stress period may extend longer than anticipated.
2. Requires greater operational attention to reconfigure system in timely manner (subject to human error).
3. Unanticipated River condition that creates system stress.

Cost Items - Scenarios 1 and 2	Nonrecurring Costs	
Original Baseline Concept	$	52,811,000
Value Concept	$	43,525,000
Avoidance	$	9,286,000
Value Study Costs	$	20,000
Implementation Avoidance	$	1,100,000
Avoidances	**$**	**10,366,000**

Cost Items - Scenario 3	Nonrecurring Costs	
Original Baseline Concept	$	52,811,000
Value Concept	$	47,617,000
Avoidance	$	5,194,000
Value Study Costs	$	20,000
Implementation Avoidance	$	1,100,000
Avoidances	**$**	**6,274,000**

Figure 6. Typical Water Demands

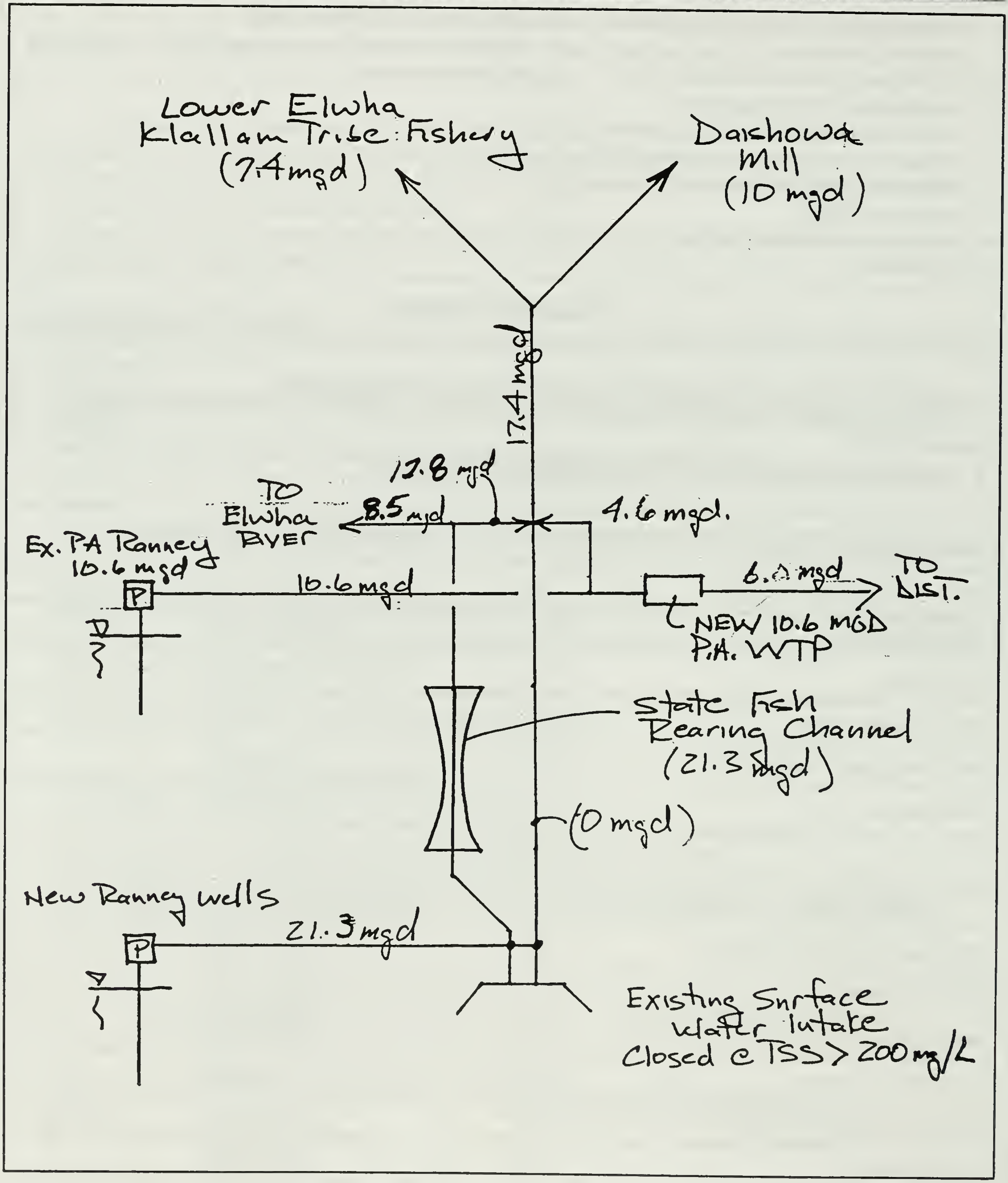


Figure 7. Minimum Water Demands

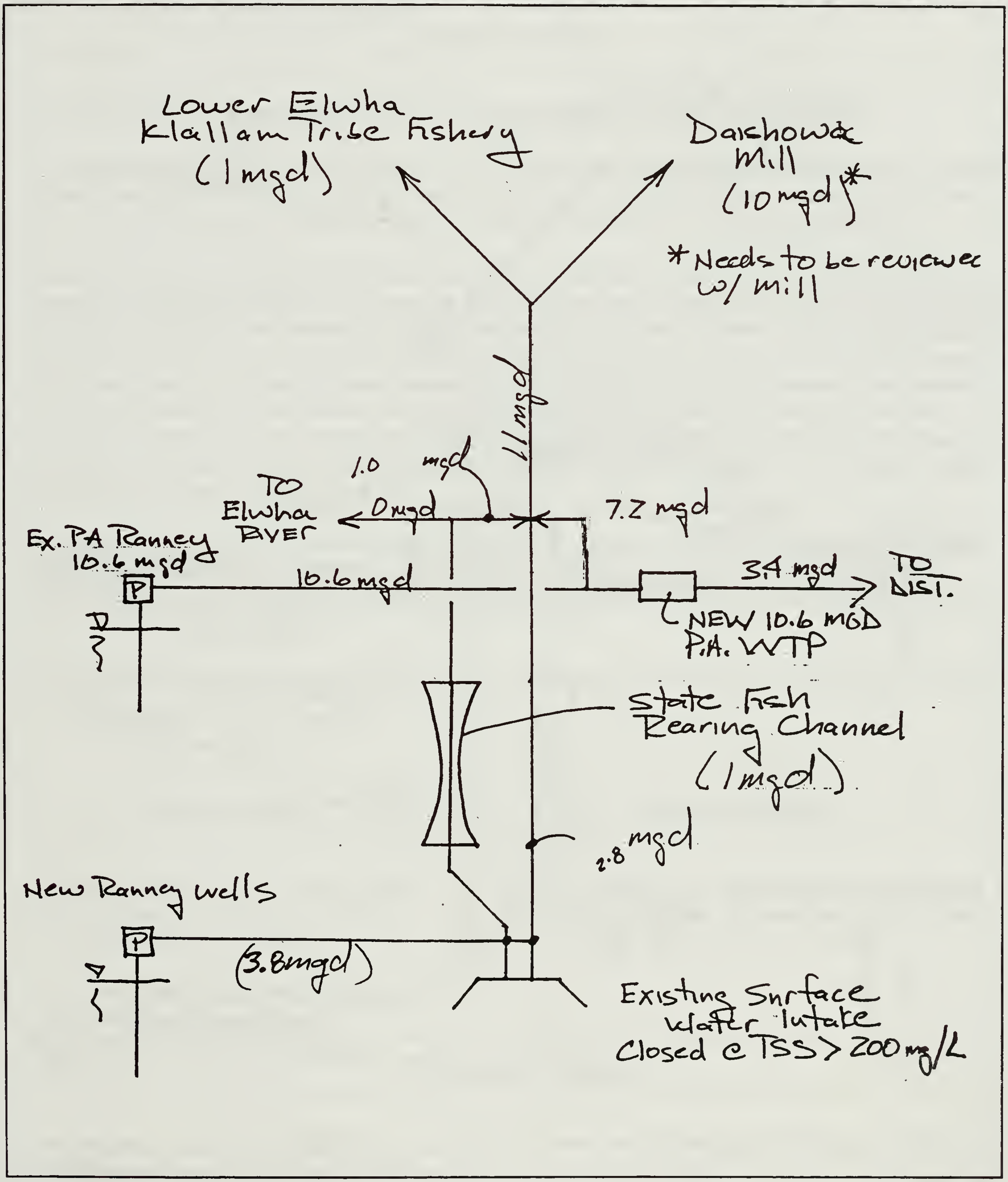
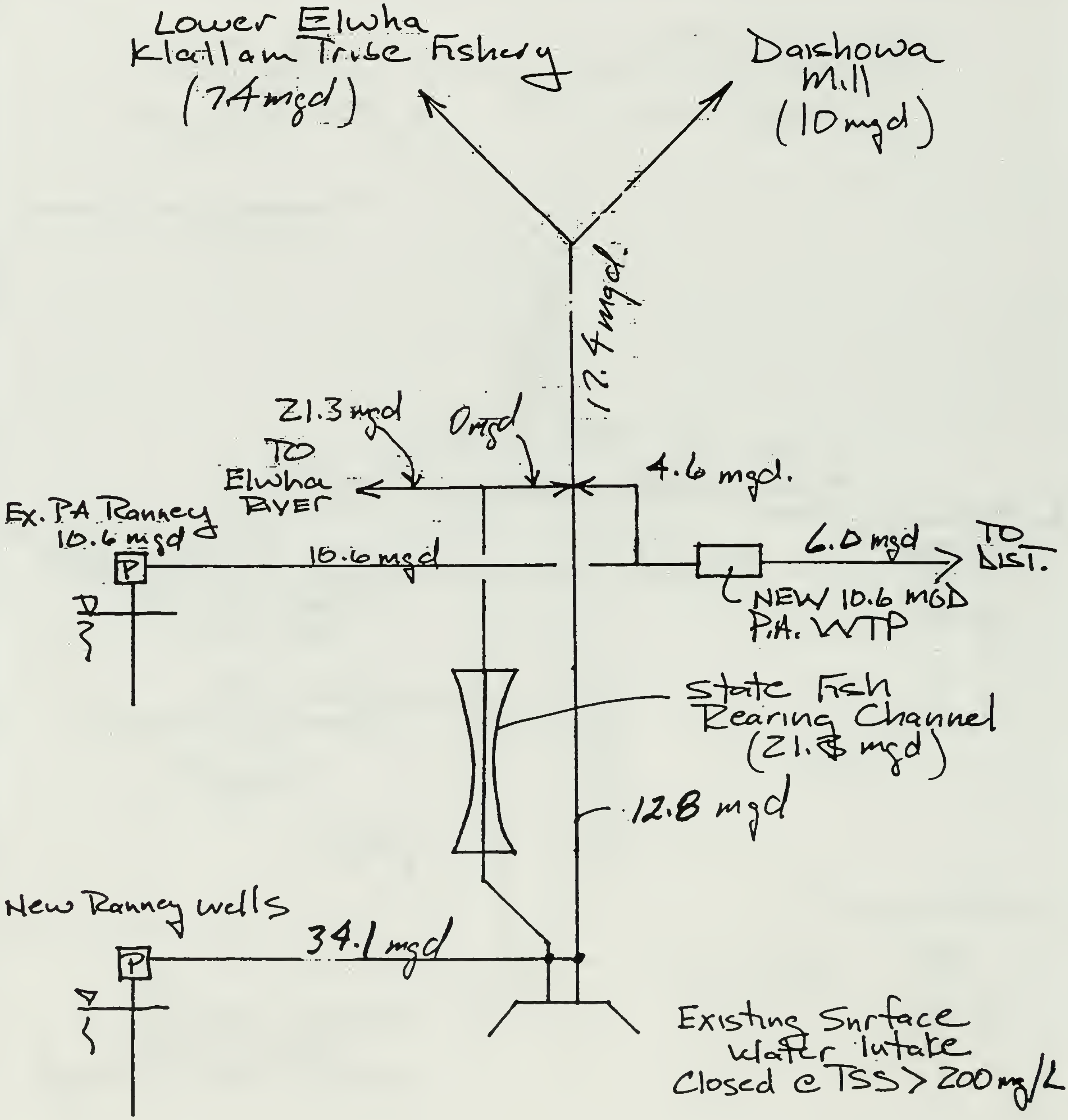


Figure 8. Typical Demands/No Connection



Proposal No. 2

Description

Proposal No. 2. Reuse Water from the State Hatchery to Supply Daishowa Mill.

- Proposal Description: Divert a portion of the flow-through water from the fish hatchery to the Daishowa Mill. This diversion is anticipated only during periods of poor water quality in the river. This water would replace water from the Ranney wells in Concept Alternative 2.

- Critical Items to Consider: The design capacity for the State Hatchery is 33 cubic feet per second. This water, for the most part, is not consumptively used and is returned to the Elwha River. Therefore, it represents a considerable supply of water for other uses if it was captured and returned to the industrial supply line during peak sediment periods. It is assumed here that the release of attraction water would not be required during peak sediment flow periods. The Daishowa Mill would have to be willing to accept the fish hatchery water which may contain increased concentrations of ammonia and biological oxygen demand (BOD) from the fish food. The fish hatcheries have variable demands that are expected to be greater in the summer and lesser in the winter.

- Ways to Implement: A small crossover channel or pipeline would collect the discharge from the hatchery and return it to the industrial water pipeline. The system would be manually controlled. Implementation would be coordinated between the staffs at the hatchery and the mill.

- Changes from the Baseline Concept: None of the existing alternatives include reuse of the fishery water.

Advantages	Disadvantages
• Reuse of fishery water will decrease the demand for clean water with a TSS of less than 200 mg/L. • Decreasing clean water demand is expected to decrease cost.	• Possible impacts for existing Daishowa water treatment plant which are unknown at this time.

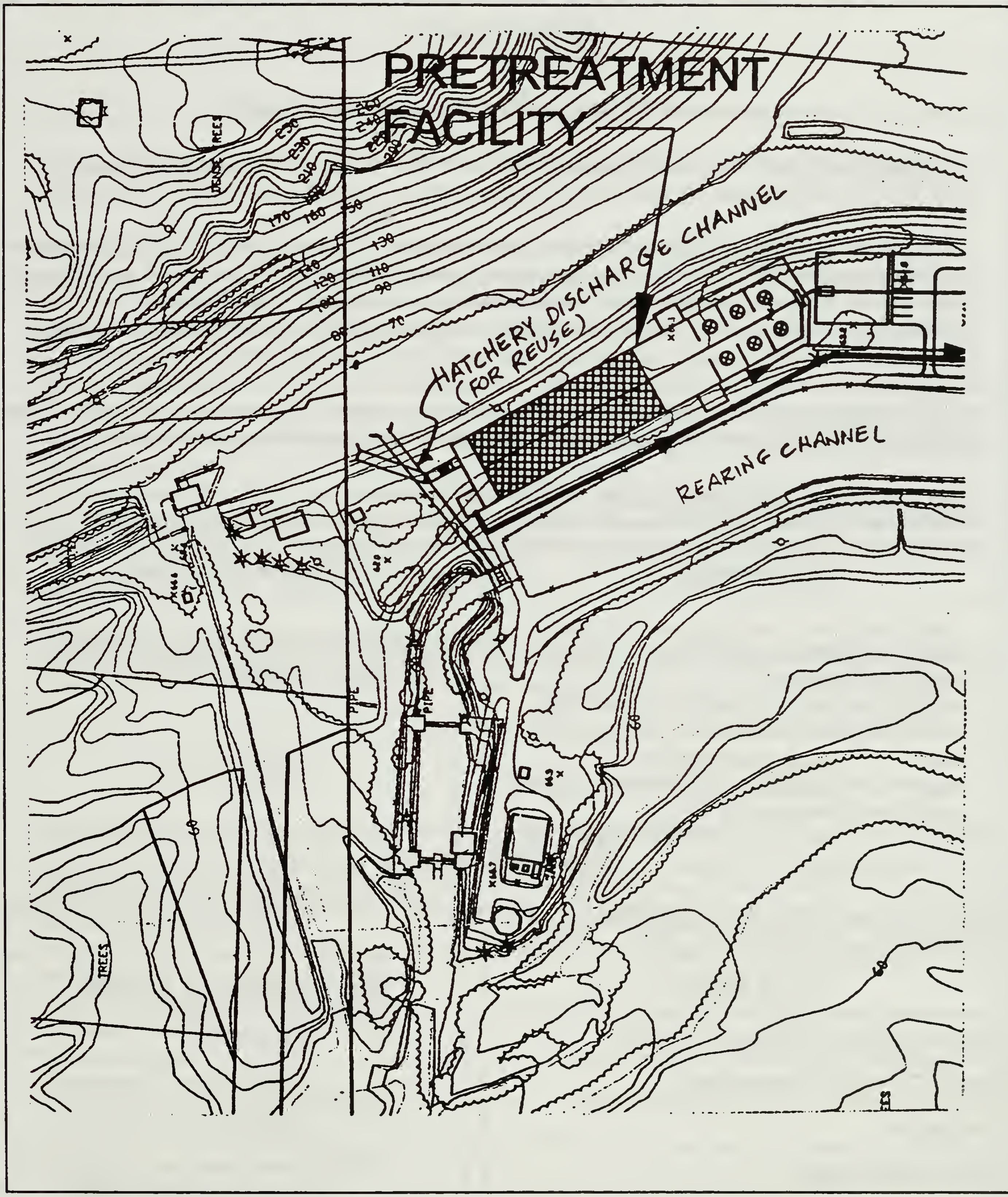
Potential Risks

The hatchery water is of slightly lower quality than water treated through a Ranney collector or by settling and may impact the Daishowa Mill in an unexpected way.

Proposal No. 2

Cost Items	Nonrecurring Costs
Original Baseline Concept	$ 32,155,000
Value Concept	$ 22,167,000
Avoidance	$ 9,988,000
Value Study Costs	$ 20,000
Implementation Costs	$ 0
Avoidances	**$ 9,968,000**

Figure 9. State Fishery Reuse Plan



Proposal No. 3

Description

Proposal No. 3. Cased Wells To Replace One Ranney Collector Well.

- Proposal Description: Replace a Ranney Collector Well proposed under Alternative No. 2 with up to 27 cased wells (@ 0.4 mgd or more each).
- Critical Items to Consider: Capacities and location of wells in a well field concept; logistics of site piping and control. The Original Baseline Concept cost below is the cost of one Ranney Well with pump and appurtenances. It assumes that controls, backup power, and geotechnical investigation costs will not significantly change from the Baseline to the Value Concept.
- Ways to Implement: Drill and install wells in phases to control and assess production. If well capacities are higher than 0.4 Mgd , less wells will be needed (additional cost savings).
- Changes from the Baseline Concept: Wells would replace one or more Ranney Collectors in Alternative 2. Lower capital investment and greater salvage value after 3-5 year need.

Advantages	Disadvantages
• Cased wells can be constructed much more quickly and easily. • Ability to control incremental amount from wells to address blending or temperature needs. • May reduce the size of the infiltration gallery needed in Alternatives 1 and 3.	• More pumps, piping, and power cable. • Likely higher operating costs.

Potential Risks

There may be a faster loss of capacity in these wells than a Ranney Collector over the course of the project.

Cost Items	Nonrecurring Costs
Original Baseline Concept, 1 Ranney	$ 2,859,000
Value Concept, 27 cased wells	$ 1,492,000
Avoidance	$ 1,367,000
Value Study Costs	$ 20,000
Implementation Costs	$ 0
Avoidances	**$ 1,347,000**

Proposal No. 4

Description

Proposal No. 4. Replace Conventional Treatment with Membrane Filtration.

- Proposal Description: The conventional treatment plant for the municipal water supply is replaced by a membrane filtration plant.

- Critical Items to Consider: Water quality is important from a fouling standpoint and pilot testing is desirable. Membrane filtration is good up to a turbidity of 200 nephelometric turbidity units (NTU), but typical river turbidity is expected to be less than 10 NTU. The dissolved organic carbon (DOC) should not be greater than 3 mg/L for prolonged periods (greater than 4 weeks) without pretreatment with a coagulant. Some membranes are intolerant of oxidants that may be required for iron and manganese control. This alternative is based on not providing any coagulant. However, a coagulant may be needed if the DOC is consistently greater than 3 mg/L or the specific ultra violet (UV) absorbency is consistently greater than 4.0.

- Ways to Implement: A pilot test can be performed on the water directly out of the Elwha to determine flux rates and fouling issues. This option is best paired with Alternative 2 which includes pre-treatment with Ranney Collectors.

- Changes from the Baseline Concept: The conventional treatment plant is replaced with a membrane filtration plant. The membrane filtration plant is less robust than the conventional plant in terms of industry experience and the range of water qualities that can be treated.

Advantages	Disadvantages
• Membrane filtration provides better removal of potential pathogens (Giardia and Cryptosporidium) than conventional treatment. • Membrane filtration is easier to operate than conventional treatment because it does not require precise chemical dosing that conventional treatment does. • Membrane filtration requires a smaller footprint than conventional treatment. • Typically produces fewer solids than a conventional treatment plant.	• Conventional treatment can treat a wider variety of source water quality than membrane filtration. • There is less industry experience with membrane filtration than with conventional treatment.

Proposal No. 4

Potential Risks

The operations and maintenance costs of membrane treatment are impacted by membrane life which is difficult to predict. Membrane equipment is proprietary and the City may be locked into a manufacturer that goes out of business or increases membrane prices significantly.

Cost Items	Nonrecurring Costs	
Original Baseline Concept	$	20,656,000
Value Concept	$	17,500,000
Avoidance	$	3,156,000
Value Study Costs	$	20,000
Implementation Costs (Pilot testing)	$	300,000
Avoidances	**$**	**2,836,000**

Proposal No. 5

Description

Proposal No. 5. Ranney Well Capacity

- Proposal Description: This proposal is closely associated with Proposal Nos. 6 and 7. In Alternative 2, the Draft Elwha Water Quality Mitigation Report (DEWQM report) provides a design requiring installation of six additional Ranney wells. It assumes that the capacity of a Ranney Well, similar to that existing on the bank of the Elwha River, is approximately 10.7 mgd . This is based on current capacity of the existing well. This number may be too conservative and should be more like the original capacity of 15.7 mgd .

- Critical Items to Consider: There are three reasons to believe that the capacity of a similar well might be as low as 10.7 mgd : 1) The capacity of the existing well is now 10.7 mgd . 2) The presence of a second well in the neighborhood may lower the capacity of a given well. 3) Periods of high solids flow in the river may reduce the capacity of the well. However, it took 23 years for the capacity of the existing well to drop from 15.7 mgd to 10.7 mgd . The question of the effect of a neighboring well is unknown, but the adjacent wells are at least 1000 feet apart. If periods of high solids flow cause a significant reduction of flow, then the existing well may not prove sufficient for municipal requirements. Interactions between neighboring wells are dealt with in Proposal No. 6. Inaccuracies in estimating capacity of the well system are dealt with in Proposal No. 7.

- Ways to Implement: The obvious way to determine the well capacity is to build the well. Since Alternative 2 in this project requires several wells, the wells should be installed sequentially with enough time between construction of a well and the next to allow for testing of the capacity of the first well constructed.

- Changes from the Baseline Concept: The baseline concept expressed in the DEWGM report uses six wells. Using a capacity of each Ranney well of 15.7 mgd , production of 58 mgd of reasonable quality water then requires four wells, not six.

Advantages	Disadvantages
• This alternative would require four, not six, new Ranney wells. The very substantial cost savings is shown below.	• The new Ranney wells may not have as high a capacity as is required. The effects of this disadvantage can be mitigated using concepts developed in Proposals No. 6 and No. 7.

Proposal No. 5

Potential Risks
It may be necessary to install an additional well which might delay the construction schedule beyond the time when installation could have been completed, if the six wells were specified in the original contract.

Cost Items	Nonrecurring Costs	
Original Baseline Concept	$	32,155,000
Value Concept	$	22,047,000
Avoidance	$	10,108,000
Value Study Costs	$	20,000
Implementation Costs	$	0
Avoidances	**$**	**10,088,000**

Proposal No. 6

Description

Proposal No. 6. Location of First New Ranney Well to be Installed.

- Proposal Description: This proposal is closely tied to Proposal Nos. 5 and 7. Locate the first Ranney well to be installed at the location of Well No.3, shown in Figure 3. In the DEWQM report, this location is about 1000 feet upstream and on the same side of the river as the existing Ranney well. Production of the existing Ranney well should be closely observed before and after inception of operation of Well No. 3.
- Critical Items to Consider: The critical piece of information gained from this action is whether installation of Well No. 3 has any significant effect of the production from the existing well. For the test, Well No. 3 should be operated at its full capacity for a sufficient period, perhaps one week, to ensure that any effect it has on the existing well will be fully expressed.
- Ways to Implement: Require the construction contractor to install Well No. 3 first, then after well construction operate both wells to determine if one well affects the other.
- Changes from the Baseline Concept: In Alternative 2, the DEWQM report proposes installation of six Ranney wells. The locations are indicated in Figure 3. The design document does not specify the sequence in which the Ranney wells are to be installed.

Advantages	Disadvantages
• The advantage of this procedure is that it will be possible to determine, at no additional cost, if there is any effect of locating a second Ranney well in reasonably close proximity (slightly over 1000 yards) of a second well. The cost advantage is shown in Proposal No. 5. • The capacity of the new well may be greater than 15.7 mgd .	• This will diminish the contractor's freedom of operation.

Potential Risks

None noted.

Proposal No. 6

Cost Items	Nonrecurring Costs
Original Baseline Concept	$ 0
Value Concept	$ 0
Avoidance	$ 0
Value Study Costs	$ 20,000
Implementation Costs	$ 0
Avoidances	**$ (20,000)**

Proposal No. 7

Description

Proposal No. 7. Sequential Installation of Ranney Wells.

- Proposal Description: This proposal is closely associated with Proposal Nos. 5 and 6. It provides a method for minimizing the number of Ranney wells to be installed. This assumes that Alternative 2 as presented in the Draft Elwha Water Quality Mitigation Report is to be followed. The design requirement for the tribal fish hatchery, after expansion, is 11% greater than that of the initial capacity of the existing well (17.4 mgd versus 15.7 mgd) so the well providing this water will have to have greater effective area (longer spokes or more spokes) if the 17.4 mgd must be supplied. Alternatively, this shortfall may be supplied by blending with river water except for those periods when the suspended solids in the river water is above about 2,000 parts per million.

- Critical Items to Consider: Since the new wells are not all to be located in a cluster, some thought must be given to the sequence in which the wells are installed.

- Ways to Implement: Install the wells in the sequence Nos. 3, 5, 2, and 4. This sequence is not absolutely critical. If the production of wells Nos. 2, 3 and 4 is not sufficient for industrial and state hatchery requirements, well No. 1 can be installed. Alternatively as above, if the shortfall is small, i.e., 10 percent to 20 percent of the total, some river water may be blended with the well water except for those periods when the suspended solids in the river are high.

- Changes from the Baseline Concept: The DEWQM report does not address the sequence in which the Ranney wells are to be installed. However it does specify installation of six wells, which appears excessive, as described in Proposal No. 5.

Advantages	Disadvantages
• The number of Ranney wells to be installed is potentially reduced from six to four, with consequent reduction in cost. The cost reduction is stated in Proposal No. 5. • By installing the wells in a sequential manner, the advantages of any successful conservation efforts can be factored into construction of subsequent facilities.	• Since the number of wells is somewhat uncertain, there may be some additional cost resulting from contractual negotiations.

Proposal No. 7

Potential Risks

The number of wells may have to be increased if the production is less than anticipated.

Cost Items	Nonrecurring Costs	
Original Baseline Concept	$	0
Value Concept	$	0
Avoidance	$	0
Value Study Costs	$	20,000
Implementation Costs	$	0
Avoidances	**$**	**(20,000)**

Proposal No. 8

Description

Proposal No. 8. Salvage and Reuse the Rayonier Water Supply Pipeline.

- Proposal Description: Salvage a portion of the 48-inch, steel-lined concrete pipeline that formerly served as the industrial water supply line for the Rayonier Mill and use it to supply water to the Lower Elwha Klallam Tribe Fish Hatchery.

- Critical Items to Consider: It is unknown at this time whether the City of Port Angeles would willingly abandoned the pipeline and donate it to the needs of the project. It is also unknown if the pipe will meet the pressure classification and other specifications for the tribal line.

- Ways to Implement: All of the alternatives currently under consideration propose various lengths of a new 30-inch pipeline to meet the supply needs of the Lower Elwah Klallam Tribe fish hatchery. Currently, about 22,500 feet of 48-inch steel-lined concrete pipe that supplied industrial Rayonier Mill is now unused. We estimate about 7000-8000 feet of pipe may be salvageable. This would potentially be enough pipe to meet all of the proposed needs for Tribal hatchery water for Alternative 2, (7000 feet) and about 75 percent of the pipe needs of Alternatives 1, 3, and 4 (10,800 feet). The most promising segment for salvage of the unused Rayonier supply pipeline is the 9000 foot segment that lies between the Daishowa Mill and the Rayonier Mill. About 4500 feet of the line in this segment rests on the surface, facilitating easy removal and inspection. The other 4500 feet is buried less than three feet below the surface. The Value Team proposes that this segment of the pipeline be inspected, and those segments that can be salvaged be removed, and reinstalled as the supply pipeline for the tribe. In reality, the salvaged line could be used anywhere in the project where a pipeline is needed.

- Changes from the Baseline Concept: This proposal is compared to the design team's Alternative 2, which specifies 7000 feet of 30-inch pipe. The salvaged line would be 48 inches, however, this should not pose a problem since it is a gravity flow system.

Advantages	Disadvantages
• This proposal would conserve materials by recycling an existing functional commodity. • Implementation may provide the City of Port Angeles an opportunity to reclaim and restore a aesthetic scenic seascape vista in the pipeline right-of-way.	• Shorter life span than a new pipeline. • Pipeline condition is unknown and field inspections verification would be needed.

Proposal No. 8

Potential Risks

Pipeline is in worse shape than originally thought possibly leading to premature failure.

Cost Items	Nonrecurring Costs
Original Baseline Concept	$ 1,428,000
Value Concept	$ 2,000,000
Avoidance	$ (572,000)
Value Study Costs	$ 20,000
Implementation Costs	$ 0
Avoidances	**$ (592,000)**

Disposition of Ideas

Value Study Elements Considered as Potential Proposals and Their Disposition	
Idea	**Disposition**
Go with all Ranney wells, and a raw water intake off the surface, and blend both sources.	Developed as Proposal No. 1.
Use State Hatchery water (less attraction flow, if needed) for input to the papermill.	Developed as Proposal No. 2.
Refine the cost of Ranney Wells (current costs, other providers).	Refer to design team for consideration.
Return State Fishery water (less attraction flow, if needed) to industrial supply line and reduce Alternative 1 infiltration gallery capacity and treatment effort by 30 cfs or reduce Alternate 2 by one Ranney well.	Developed as part of Proposal No. 2.
Review Ranney well capacity. Is 10 mgd enough, why not more?	Developed as Proposal No. 5.
Install Ranney wells sequentially. Start with No. 3 and see if it influences No. 4. Then adjust spacing (optimize capacity) as necessary.	Developed as Proposal Nos. 6 and 7.
Use Ranney wells sized for current demand for industrial needs. Design for 48 cfs and use fisheries outflow as backup or add a Ranney well for backup, and maintain surface water diversion.	Refer to design team for consideration.
Use aquifer water storage and recovery to meet peak demands, downsize facilities for industrial and municipal supply.	Refer to design team for consideration.
For the municipal water treatment system, go with rapid mix flocculation and multimedia filtration (eliminate clarification).	Refer to design team for consideration.
Salvage the existing waterline between the Daishowa and Rayonier Mills to use for the Tribal hatchery.	Developed as Proposal No. 8.
Make industrial water treatment in Alternative. 1 modular to facilitate reuse somewhere else after the 7± years of use	Refer to design team for consideration.

Disposition of Ideas	
Delete the infiltration gallery in Alternative 3 and use the reservoir for supply until the peak passes.	Refer to design team for consideration.
In Alternative 1 build one set of settling basins and split the flow to industrial and city users.	Refer to design team for consideration.
Evaluate Daishowa discharge water for reuse for fisheries or municipal needs.	Refer to design team for consideration.
Develop unit cost for alternatives based on life cycle costs (include O&M).	Refer to design team for consideration.
Use a well point system for industrial source instead of Ranney wells.	Refer to design team for consideration.
Test sediment spreading in the river. Place sediment or other media in the river and measure attenuation and duration for the sediment/media event to pass the intakes.	Refer to design team for consideration.
Look at flows and durations from Mount St. Helens, including secondary damage to better estimate impact of sediment release.	Refer to design team for consideration.
Aggressively pursue short term conservation efforts.	Refer to design team for consideration.
Stage the construction of Ranney wells in Alternative 2 over several years (build closer to need).	Developed as Proposal No. 7.
Reuse tribal fisheries discharge for Diashowa intake.	Refer to design team for consideration.
Drill six more State hatchery wells, install pumps as needed or in just two or three wells.	Developed as Proposal No. 3.
Internal reuse of Daishowa mill, National Park Service (NPS) could pay for reuse facilities to minimize water needs.	Refer to design team for consideration.
Provide a 44.5 mgd infiltration gallery intake that is not used until worst sediment periods are over.	Refer to design team for consideration.
Increase the capacity of the existing Ranney well.	Refer to design team for consideration.
Design a Ranney well with a higher capacity.	Refer to design team for consideration.

Disposition of Ideas	
In Alternative 4, decrease the pipe diameter and augment flow with fishery water.	Refer to design team for consideration.
Augment Daishowa mill with backwash water from the water treatment plant.	Refer to design team for consideration.
Build storage at Morse Creek or the Little River.	Refer to design team for consideration.
Show the cost share potential from the Tribe, City, County, State, and others. The study and design teams do not need it, but the decision makers, NPS and Congress need it.	Refer to design team for consideration.
Develop a well field to supply backup source for city and go to a membrane filtration for treatment.	Refer to design team for consideration.
Obtain the geologic report for Alternative 2 for less than $750,000.	Refer to design team for consideration.
Use Alternative 2 with membrane filter plant.	Developed as Proposal No. 4.
Review cost models for value mis-matches.	Refer to design team for consideration.
Better determine duration and concentrations of sediment flows.	Developed as part of Proposal No. 1.
In Alternatives 3 and 4, remove the infiltration gallery and let the reservoir provide storage during shutdown; blend with low TSS water.	Refer to design team for consideration.
Define flexible alternative methods of operation including mixing, switching, blending, storing, and conservation.	Referred to in Proposal No. 1. Refer to design team for consideration.

List of Consultants

Consultant or Contact	Topic or Information
Dean Reed Daishowa America Port Angeles WA 98362 360-452-0657	Acceptability of using hatchery discharge for processing at Daishowa Plant.
Paul Mueller Project Engineer CH2M Hill 2300 Northwest Walnut Corvallis OR 97330 541-758-0235 extension 3418	Cost and membrane filtration.

Data and Documents Consulted

Title, Author, and Date	Information
Draft Elwha Water Quality Mitigation Project (DEWQM report) November 6, 2000, URS Corporation	Performance of Ranney Wells and cost estimates.
Elwha River Ecosystem and Fisheries Restoration Project - Sediment Analysis and Modeling of River Erosion Alternatives, U.S. Department of the Interior, October 1966. Tim Randle, Hydraulic Engineer, Sedimented River Hydraulics Group, U.S. Department of the Interior, Bureau of Reclamation, Technical Service Center, Denver, Colorado	Sediment loading concentrations.

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November 6, 2000 - 8 a. m.

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